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This monograph is based on tests developed for Project Talent, a research project conducted at the University of Pittsburgh through the cooperative assistance of the U.S. Office of Education the National Institute of Mental Health, U.S. Office of Naval Research, and, in the planning stages, the National Science Foundation.

Gives historical background, general purpose, description, factors measured, and interpretation for each of the following types of standardized tests: Information, mechanical information, electrical and electronics information, vocabulary, memory for sentences, memory for words, disguised words, English, word functions in sentences, reading comprehension, creativity, mechanical reasoning, spacial visualization, abstract nonverbal reasoning, arithmetic reasoning, high school mathematics, arithmetic computation, table reading, clerical checking, and object inspection.

One section of the monograph discusses the purposes of standardized tests: Achievement tests, aptitude tests, and test combinations (general intelligence tests, nonverbal intelligence tests, omnibus selection tests, multiple aptitude test batteries, and achievement test batteries). Final chapter lists 62 references. Includes extensive bibliography.

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Types of Tests
in
Project Talent

Standardized Aptitude and Achievement Tests

by

JOHN T. DAILEY and MARION F. SHAYCOFT

University of Pittsburgh

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
ABRAHAM A. RIBICOFF, *Secretary*

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Foreword

THIS MONOGRAPH is a reflection of the interest in testing caused by the impact it has had and is having on our educational system. It is the purpose of this publication to provide a brief outline of the history, development, and general use of many of the common types of standardized aptitude and achievement tests given in schools. Although this monograph is based on the tests that were developed for Project Talent, they are similar to most of the tests that have been used throughout the Nation's schools. Project Talent is a research project conducted at the University of Pittsburgh through the cooperative assistance of the U.S. Office of Education, the National Institute of Mental Health, U.S. Office of Naval Research, and, in the planning stages, the National Science Foundation.

Three types of monographs are presented in the Cooperative Research monograph series. This monograph exemplifies the type which contains a report on conferences, papers, or certain aspects of completed and on-going cooperative research projects that have a specific bearing on the development, stimulation, and understanding of certain educational research problems. For example, this monograph describes the types of tests constructed for use in Project Talent. The second type includes information on a final report or a part of a final report of one research project. The third type includes two or more final reports on cooperative research projects that focus on a particular problem.

It is hoped that a presentation of a brief historical background, purpose, description, factors measured, and interpretation of common types of standardized tests as represented in the Project Talent Battery of Tests will assist school personnel in making the fullest use of these types of instruments when planning programs for and with students.

DAVID L. CLARK,
Director,
Cooperative Research Branch

JOHN G. LORENZ,
Acting Assistant Commissioner
for Research

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Types of Tests in Project Talent

I. Introduction

FOR AT LEAST 25 years there has been an awareness of the need for a program of research which would, on a nationwide basis, yield factual information on the nature and distribution of human talents and on how to assist individuals to identify, develop, and use them.

One proposal was that of Herbert A. Toops (55) [1], of the Ohio State University, who suggested the selection of a "standard million" to provide the basis for precise standards and norms representative of the total population of this country. Following the development of scaled scores and norms for the Cooperative Achievement Tests in 1940, John C. Flanagan (20) presented a proposal to the Committee on Measurement and Guidance of the American Council on Education to draw a national sample for standardizing aptitude and achievement tests. After World War II, Robert L. Thorndike (51) of Columbia University proposed a national census of aptitudes.

Although there has been a considerable amount of activity in this field, studies involving tests have used only a single intelligence test or various achievement measures. There was an urgent need for a comprehensive survey including aptitude, interest, and motivational and background factors, to be accompanied by intermediate and long-range followups of the individuals studied in the survey. Through the cooperative assistance of the U.S. Office of Education, the National Institute of Mental Health, the National Science Foundation, and the U.S. Office of Naval Research, a research study was planned and the testing was carried out in the spring of 1960.

The study known as Project Talent (58) is the first scientifically planned national inventory of human talents. A scientifically selected sample of approximately one-half million high school students was given a 2-day series of examinations administered in March, April, and May, 1960. These students were representative of the local school systems all over the Nation—in the country and city, and in public, private, and parochial schools. This tremendous program was made

[1] Numbers in parentheses refer to the publications listed at the end of the monograph.

possible through the cooperative efforts of school administrators, principals, and teachers in the sample schools who worked with 90 regional coordinators for the project.

The tests used in the project were developed by the staff.[2] They were based on detailed specifications set up by the staff and the advisory panel subsequent to a year's intensive study.

To advise on the selection of the specific types of test and measurement devices to be developed, a panel of seven outstanding authorities representing a wide variety of specialties and experience was selected. The members of the advisory panel included: Robert L. Thorndike (chairman) head, Department of Psychological Foundations and Services, Teachers College, Columbia University; Henry Chauncey, president, Educational Testing Service; Wayne Holtzman, associate director, Hogg Foundation; Paul Horst, professor of psychology, University of Washington; Lloyd G. Humphreys, professor of psychology, University of Illinois; E. Lowell Kelly, chairman, Department of Psychology, University of Michigan; and Joseph Zubin, principal research scientist, Division of Research and Medical Services, New York State Department of Mental Hygiene.

The 2-day battery of tests was designed to measure as many as possible of the kinds of aptitude and achievement that have proved to be useful and important in the selection, measurement, and guidance of young people at the secondary school level. Questionnaires were included to obtain important background information regarding the previous experiences of each student—his neighborhood, family, community, activities, etc. There was also some coverage of motivation and the student's level of vocational and economic aspirations, as well as his personal interests and vocational plans. The tests were designed to measure the functions covered by most of the standardized tests now widely used with high school students. Moreover, they were designed to measure these functions in such a way that the battery of tests would be a distillate of the "state of the art" of test development today. Much has been learned through the years about measurement in general, and test development in particular, and an effort was made to have the resultant battery reflect this accumulated knowledge, in terms of both the choice of functions to be measured and the determination of types of items to be used to measure them.

After the choice had been made of the types of aptitude and achievement tests to be developed, specifications were developed for each type of test. No test is an exact duplicate of any existing commercial test.

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[2] The Project Talent staff is under the direction of John C. Flanagan, professor at the University of Pittsburgh and director of the American Institute for Research. John T. Dailey is program director Other full-time research staff members include Marion F. Shaycoft, William D. Gorham, David B. Orr, C. A. Neyman, Jr., and Isadore Goldberg.

The tests will be withheld from subsequent publication; however, the test results have been made available to the schools selected as a part of the study.

In the design of Project Talent, it was recognized that many educational research personnel and organizations not directly associated with the project would probably be interested in using the bank of information provided by Project Talent as a source of data for research studies in their interest areas. It is planned that special analyses of the data on file on the tape at the University of Pittsburgh will be made possible at an appropriate time and on a cost basis for studies originating outside the project itself. When the data have been fully processed and edited on the tapes, a review committee will be set up to receive and approve requests for these special analyses.

The following types of aptitude and achievement tests were included in the Project Talent test battery:

1. Information (containing items in the following areas):
   a. Vocabulary
   b. Literature
   c. Music
   d. Social studies
   e. Mathematics
   f. Physical science
   g. Biological sciences
   h. Aeronautics and space
   i. Electricity and electronics
   j. Mechanics
   k. Home economics
   l. A number of other areas of information, many of them nonscholastic in character.
2. Memory for sentences
3. Memory for words
4. Disguised words
5. English
6. Word functions in sentences
7. Reading comprehension
8. Creativity
9. Mechanical reasoning
10. Visualization in two dimensions
11. Visualization in three dimensions
12. Abstract reasoning
13. Arithmetic reasoning
14. Mathematics (other than arithmetic reasoning and computation)
15. Arithmetic computation
16. Table reading
17. Clerical checking
18. Object inspection

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After the Project Talent tests had been developed, it was agreed by the Cooperative Research and Project Talent staffs that the results of the extensive planning that constituted the basis of the tests should be published in the form of a monograph suitable for use in guiding classroom teachers in understanding many of the common types of tests being widely used in schools. It is hoped the present report will help fulfill this purpose.

As has been indicated, determining the types of tests to be used in Project Talent and developing the whole procedure of rationales and specifications represented, in effect, a survey of "the state of the art" in regard to common aptitude and achievement tests that could be administered in classrooms by classroom teachers. An extensive analysis of the above tests, which were given experimentally to approximately 6,000 students in 11 high schools in May 1959, demonstrated that each contributed unique information about the students that was not measured by the other tests in the battery.

Each type of test is outlined in section II of this report.

II. History of Objective Tests

THE USE of objective tests as a source of information about individuals has a surprisingly long history. The concept of testing of individuals for selection appears in the Old Testament (32). There are references to test situations which are clearly parallel to an individually administered psychological examination today. It is recorded that at the time of Christ (42) there were well-established competitive civil service tests being used in China as a routine procedure. During the 19th century, the use of statewide written examinations to check on the achievement of high school students was begun in the United States; for instance, New York State's system of Regents examinations was well established by the 1860's. A compilation of all the items used in the Regents examinations (39) in New York State from 1866 to 1878, includes some measures of aptitude and many common types of items similar to those used today for the measurement of achievement. It is probable that if these items were converted into modern multiple-choice form, they could be organized into tests that would correlate highly with many of our widely used tests today.

Sir Francis Galton (25) is generally regarded as being the "father of mental testing." In the 1880's, he established a laboratory where he administered a series of physical and mental tests to a number of individuals.

In 1890, Cattell (6) reported on a series of tests he had developed and tried out a number of subjects in the hope of finding a way of appraising their abilities in order to predict college success. These tests consisted of measurements of keenness of vision and hearing, color vision, sensitivity to pain, color preferences, reaction time, rote memory, mental imagery, etc. A few years later, the results of these tests were compared with college grades by Wissler (60). No significant relationships were found. Perhaps Wissler should be regarded as the "father of test validation." Wissler's study was a body blow to the mental test movement at that time. It marked a dead end to the initial approach of measuring intelligence through simple sensory and perceptual tests.

Alfred Binet, using a basically different theory and method from the earlier group, was the first to develop an intelligence test that could differentiate between those who could succeed in school subjects and those who apparently could not. The basic tests Binet experimented with were described by Münsterberg (35) in 1891, and by Binet and Henri (2) in 1896. Their tests represented fairly complex tasks or problems to be solved. In 1905, the first Binet intelligence scale (3) appeared. The scale included 30 items of a wide variety of types. Included among them were such tasks as carrying out orders, enumerating objects in pictures, repeating sentences after hearing them dictated, stating similarities of pairs of familiar objects, completing sentences by supplying the missing word, and differentiating between pairs of abstract terms. Refined versions of the Binet scale appeared in 1908 and 1911.

Binet's tests were quickly recognized as being of significance and therefore were translated and tried out in this country. A great deal of experimentation aimed at perfecting the Binet approach led to the publication by Terman in 1916 (49) of the Stanford revision of the Binet scale. The Stanford-Binet gained immediate popularity. To this day it remains the most widely used individual intelligence test for children. It was revised in 1937 and again in 1960.

As early as 1897 an objective spelling test (41) had been given to approximately 20,000 students. Normative analyses were made of the results. Well before World War I, standardized achievement tests in various areas were used and had evolved to resemble closely some contemporary achievement tests.

It was World War I, however, which gave real impetus to the development of the modern mental-test movement. During the war, a committee of eminent psychologists was given the mission of designing intelligence tests for the screening of Army recruits (62). Some of the tests were to be designed for the testing of illiterates and non-English-speaking persons; they were to be in a nonverbal form and they were to be administered to groups. About 50 different types of items (62) were proposed to this committee for inclusion in the Army-recruit screening examinations. After tryout on several groups of recruits, approximately 20 were accepted and appeared in various forms of the Army Alpha or Beta intelligence examinations. (The Alpha was the examination intended for general use, with recruits able to read and write, and the Beta was the nonverbal examination designed for persons unable to read English.) Most of these types of items were later widely used in intelligence tests and are in widespread use today.

An examination of the 30 types of items that were not accepted is interesting, since modern tests measuring primary mental abilities use

items closely resembling some of them, for instance, items measuring such abilities as spatial visualization, abstract reasoning, and mechanical comprehension. Many of these items were rejected at the time on the basis that they were not really measures of intelligence.

After World War I, the eight types of items used in the Army Alpha were incorporated in various combinations into many of the widely used group intelligence tests developed in the 1920's and 1930's.

A different approach was that of Paterson and his associates (37), who developed a comprehensive program of research on specific occupational aptitude tests through the Employment Stabilization Research Institute of the University of Minnesota (38). This work later led to the similar program of the Occupational Analysis Division of the U.S. Employment Service (16).

In the late 1930's, after the rise of factor analysis, various types of items began to be analyzed separately instead of being grouped together under the overall heading of "intelligence"; they then emerged as important factors in their own right. Many of them played a large part in the multiple-aptitude batteries developed during and after World War II.

During World War II, much work was done on the development of multiple-aptitude test batteries for the purposes of screening and classifying military personnel. In the Army Air Corps (22) during this period, many psychologists in uniform experimented with numerous items, including nearly all the common types plus many special ones. They systematically sorted out the tests by factor analysis and other statistical techniques into groups of specific-aptitude tests (28). It was found during this period that it was possible with a 1-day test battery to measure many important aptitudes (15). These separately measured aptitudes could then be combined into composite scores, each of which would predict success in a specific kind of occupational assignment in the Armed Forces. This procedure was found to be both economical and efficient, since duplication would have resulted if separate tests had been developed for each kind of occupational assignment. Moreover, it was found possible to use tests with much greater precision when the aptitudes were measured separately. For example, considerable weight could be given to various important aptitude measures without simultaneously increasing the effective weight of the verbal factor.

It was found, too, that the multiple-aptitude approach to measurement had other advantages over "omnibus tests" [1] from the theoretical and interpretative point of view. For instance, clear relationships could be determined between specific aptitude measures and well-

[1] An omnibus test is a test from which only a single score is derived and the various kinds of tasks are distributed throughout the test instead of being grouped by kind.

defined job elements, relationships which become obscured when omnibus tests are used.

After World War II, the Army (40) and Air Force (11) developed and adopted multiple-aptitude test batteries for the screening and classification of their enlisted personnel. They have maintained continuing programs to relate their aptitude tests to later occupational adjustment and job performance in the Armed Forces. A considerable part of today's information on tests and their relationship to job performance comes from these extensive programs. After World War II, many multiple-aptitude test batteries were developed commercially. Most of these followed rather closely the basic pattern established initially by Thurstone (53) with his primary mental abilities and later by the World War II multiple-aptitude test batteries. A somewhat different approach has been the establishment of a standard aptitude classification system based directly on job elements (23). In this, the tests are designed to tap job elements found through intensive and systematic analysis of vocational and occupational tasks and behaviors.

Among the largest testing programs today are those for college entrance. These programs usually consist of either a test of intellectual aptitude or intensive measures of achievement in various areas or both. The college entrance tests are taken each year by well over a million high school students; they play an important part in the admissions standards of many colleges and universities.

Of increasing importance are the various testing programs for the awarding of scholarships. In general, these tests parallel in content college entrance tests of the academic-aptitude type. Since their purpose is the selection of outstanding students to receive the scholarships, their items tend to be more difficult than those in typical college entrance examinations.

The Federal Government has a number of well-developed testing programs for the selection, classification, and assignment of its own personnel; they range from the usual list of civil service examinations and employment service examinations to tests for the selection of technicians, specialists, and potential top administrators.

III. Types of Standardized Tests

In this section of the report, items from the Project Talent tests are presented as being representative of common types of standardized aptitude and achievement tests; a brief historical background, general purpose, description, factors measured, and interpretation of the various types of tests are outlined.

1. Information

HISTORICAL BACKGROUND

Information tests which require recall or recognition of verbal or other material are, of course, among the oldest types of tests. As long as teachers have been constructing and giving tests of their own they have been making widespread use of information test items, usually in completion form. Such tests of information are highly developed today and form an important part of many types of tests.

General Information was one of the subtests of the famous Army Alpha (62) of World War I. Some of its information items were exceedingly easy and were put in for the purpose of screening illiterates. For instance, there were items testing knowledge of the fact that it is more likely to snow in the winter than in the summer, knowledge of the fact that eggs come from a hen, and the like. The Army Alpha General Information Test covered a wide range of subject matter; it included information items on animals and birds, physical science, biological science, farming, ranching, mechanics, social science, electricity, medicine, games, business, foods, airplanes, sports, guns, law, literature, and art. This test came primarily from the work of Otis (62).

Information items have also been used in many other general intelligence tests. In the 1930's, there was some experimentation by John C. Flanagan with wide-range information (19) and by E. B. Greene with vocabulary tests (27) to measure interests. During World War II, many such tests were developed (28). They have been shown to be useful in measuring interest in several areas; for instance, in learning to fly (56).

GENERAL PURPOSE

A general information test is often used as part of a test of general academic intelligence. In some cases subscores on information in various subject-matter areas are used as an indication of interest in participating in activities in those areas. For this purpose, a wide-range information test may provide a profile of measures of level of information in a number of academic and nonacademic areas. It is hypothesized that the extent to which a person is interested in a specific area may be deduced from the shape of his profile as expressed by test results, and particularly from the relation between his level of information in the area in question and his level of information in other areas. This hypothesis is based on the premise that the individual will tend to know most in the areas where his interest is greatest.

In most of the areas covered in the Project Talent Information Test, there are short concise items measuring knowledge of technical or specialized vocabulary terms and other kinds of information. It is assumed that knowledge of technical vocabulary in an area accompanies other kinds of information in the area. There is much evidence to indicate that this is true. The inclusion of both specialized vocabulary and short information items increases the flexibility and scope of tests of this type.

The Project Talent Information Test also measures information in a number of specialized areas such as natural sciences, social studies, literature, art, and electronics. Scores in these areas are useful for many purposes in addition to serving as a basis for inferences about interests. The amount of information a person has in a particular area may well be significant in its own right. Therefore, to the extent possible, certain sections of the test were designed so that scores on them would have some absolute meaning in the sense that the items were a representative sample of a carefully defined domain of knowledge.

The overall score on the Project Talent Information Test might have considerable value in predicting success in college, for example, or might also help define a useful new dimension in personality analysis.

Vocabulary.—A subset of items of the conventional vocabulary type, scattered throughout the Project Talent Test, provides a "vocabulary score" which should be comparable to that provided by typical multiple-choice vocabulary tests.

The Project Talent Test also provides a screening score which will be a measure of the student's ability to read well enough so that his scores on this and other tests in the battery will not be invalidated by failure to comprehend the items. This score, considered in conjunc-

tion with the pattern of scores on other tests in a comparable comprehensive battery, will also provide some indication as to whether the student has treated the test-taking as a serious task and whether his responses are reasonably free of careless clerical errors (i.e., accidentally marking a different answer space from the one intended). The appropriate interpretation to be assigned to a low screening score (e.g., feeblemindedness, illiteracy or reading disability, flippancy, carelessness, lack of motivation, etc.) cannot be determined solely on the basis of the screening; the whole pattern of scores is needed.

DESCRIPTION

Academic areas

Since the general purpose of these subscores is to measure the acquisition of information in the area in question, items sample the field as broadly as is feasible with a relatively small number of items. Special attention is paid to syllabuses representing the prescribed course of study in various States and other jurisdictions. Coverage includes things learned in school and things learned outside of school through independent reading, radio, television, and other sources. The following domains are covered.

Literature.—The chief "common body of literature" to which a sizable proportion of the group tested is likely to have been exposed—apart from the nursery rhymes and fairy tales of the preschool age—is that which is either required reading in school or is on school-issued lists of recommended reading. This body of literature is the basis of many of the literature items in the Project Talent Information Test.

Social studies.—The test samples social, economic, political, and historical concepts, such as: Representative government, the industrial revolution, the Bill of Rights, taxation, profit, political parties, or the westward migration. Samples are based on representative social studies curriculums from various States and cities; the list covers the major areas of social studies taught in elementary school and in high school, whether as required or optional subjects. Also, materials not necessarily taught in high school have some representation in the test, since it is felt that voluntary reading or the acquisition of knowledge in other ways indicates special interest in the area. Both vocabulary items and items testing other kinds of information are included. Items likely to become dated within 20 years or whose significance is likely to change markedly within that period were kept to a minimum; for this reason, little emphasis was placed on current events.

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Natural science.—The concepts sampled are based on representative curriculums from various cities and States and cover topics taught in elementary school and high school, including both the physical sciences (chemistry, physics, astronomy, geology, meteorology, etc.) and the biological sciences (botany, zoology, microbiology). Vocabulary items and items testing other kinds of information not necessarily acquired through formal instruction in science are included, since it is felt that the acquisition of knowledge through voluntary reading or experimentation, for example, indicates special interest in the area.

Mathematics.—The mathematics items in the Project Talent Information Test do not overlap the coverage of other mathematics tests such as arithmetic computation, arithmetic reasoning, or mathematics achievement. The list of concepts is based on representative high school mathematics curriculums, and the items concern concepts, facts, notation conventions, etc., that can be tested factually without requiring computation, reasoning, or other specific skills normally tapped in a problem-solving test.

Among the items are some on information that might be acquired in other ways than through instruction in mathematics. (The impossibility of trisecting an angle by Euclidean means, for example, is not generally included in high school mathematics curriculum.) The history of mathematics is not included, but within the above limitations the items sample the field as broadly as is feasible.

Nonacademic areas

In general, items for some scales in the Project Talent Information Test give an advantage to the examinee who has participated in the activity in question, as follows:

1. A hobby or voluntary extracurricular activity (e.g., electronics, carpentry, mechanics, cooking, sewing, photography, sports, games, theater, ham radio, music, art, journalism, etc.).
2. A household chore (e.g., cooking, sewing, baby care, home maintenance and minor repairs, farm chores, etc.).
3. A part-time or summer job (e.g., babysitting, office jobs, etc.).
4. Extracurricular reading with a direct or indirect bearing on the area in question (e.g., engineering, architecture, law, medicine, aeronautics and space, photography, etc.).
5. Special activities such as attending museums (in the case of art) or concerts (in the case of items on music).
6. Keen observation in some area (e.g., in the case of items on architecture, the examinee who has been observant in regard to the architecture around him should have an advantage).
7. Special training or education. Art items, for instance, give an advantage to those who have had special training in art.

Mechanical Information.—The subscore in this area is expected to correlate with aptitude for work as a mechanic or in allied fields. Two areas of knowledge are included under this heading:

1. Tools, carpentry, construction, etc.
2. The operation and maintenance of motors and various other kinds of mechanism.

The emphasis is on information acquired through direct experience with tools and motors. Items designed to measure information that would be acquired in an academic course in science (e.g., a course in physics) are in most cases included in the science rather than mechanics score; items involving "intuitive" comprehension of mechanical principles and everyday physical forces such as gravity, equilibrium, pressure, etc., but no particular knowledge of mechanics are in the Project Talent Mechanical Reasoning Test; items requiring a comprehension of electricity are in the electricity and electronics subscore, even if they are concerned with motors.

Electricity and electronics.—The subscore in this area is intended to have a positive correlation with aptitude for work as an electrician or electronics technician.

The items stress information that can be acquired through direct experience in the construction and maintenance of electrical and electronics equipment; thus examinees who have worked on radios, hi-fi sets, or other electronic equipment have an advantage.

It is inevitable that some of the items also can be answered on the basis of information acquired in formal courses in physics and to a lesser extent in chemistry. However, items that can be answered on this basis, even by persons who have not had much direct experience in constructing or maintaining electrical or electronics equipment, have been kept to a minimum.

Sports.—Information about sports is acquired in at least three ways: by direct participation, by being a spectator, or by reading. An effort has been made to include some items which are likely to be known only by those who have participated directly in the activity.

There is broad coverage of individual and team sports. While opportunity for some sports (e.g., canoeing, fishing, skiing, iceskating, golf, etc.) may be limited in certain geographical areas, most high school students have the opportunity to participate in *some* sports if they are interested. A broad sampling of sports insures that some available sports will be included for all areas of the country. Items on strictly regional practices were minimized.

Engineering.—These items may be indicative of interest in and aptitude for engineering as a career. They are distinct from the "mechanics" items, intended to indicate aptitude for work as a mechanic.

Health.—These items may help to indicate interest in the general area of health, including careers in medicine, dentistry, nursing, pharmacy, public health, etc. Areas sampled include knowledge of physiology, nutrition, first aid, common ailments, hospitals, X-rays, physicians' instruments (stethoscope, for example), training requirements for careers in the area, etc.

Theater.—Items in this area should indicate the degree of interest in the theater. (It is doubtful, however, whether it is possible to get much differentiation between those who are interested in the stage as a career and those who are interested merely as spectators.) Most of the items concern knowledge of theater terms (e.g., greasepaint, footlights, etc.).

Farm and ranch.—Items are intended to represent the kinds of special information that children who grow up on farms or ranches are more likely than city children to acquire. The items give some advantage to examinees who have an interest in various aspects of rural life.

Photography.—Information that is acquired principally through having photography as a hobby—taking pictures, processing them, and also, to a certain extent, reading about photography, attending exhibits, and manifesting interest in other ways—is tested by items in this area.

FACTORS MEASURED

A general information test is of course expected to measure how much an individual knows about various subjects. Although this is often of value, it is obvious that real achievement in a specific area involves more than mere factual information; it requires among other things the assimilation of the information and the ability to synthesize and integrate it into meaningful patterns. However, there is a great deal of evidence that, at least in our culture, the person who knows the most about a great variety of things is most likely to be able to learn similar information in a training situation. It is therefore legitimate to use a measure of general information as an indication of "intelligence" in the sense of potential for further learning. In the evaluation of an individual's potential achievement in any given area, it is important to know how much information he has already acquired in that area.

Scores on information tests are, of course, heavily influenced by the total pattern of previous experience. However, if a wide range of information is covered, the overall score may not be greatly influenced by the specific pattern of courses taken so much as by the stu-

dent's personal interests. This type of test measures the relation between an individual's level of information in a given area and his levels of information in other areas, thereby indicating the extent of his interest in a certain activity.

Information scores in specific areas, such as aeronautics, electricity, mechanics, physics, and mathematics, have been used with outstanding success in many cases in vocational aptitude batteries. It has been found that information in specific areas related to the occupational training program being studied usually correlates very well with success in training in that area.

INTERPRETATION

The amount of exposure to information of various kinds must be considered in interpreting how much information an individual has. Number of years of attendance in school, for instance, is relevant. An individual who has had very little formal schooling has had less opportunity to acquire information in areas related to school. Environment, too, should be considered in interpreting the test. Of particular significance, of course, would be any specific linguistic handicaps. However, the well-trained counselor will not overlook such conditions as he interprets a given set of test scores and other information of this type.

2. Mechanical Information [1]

HISTORICAL BACKGROUND

Among the first tests of mechanical information were the early trade tests (54) in World War I, where specific information tests were developed for various mechanical occupations in order to measure the achievement of individuals in those fields. The items in the tests were similar in format to the current types of mechanical information items. The Army Alpha had a few information items on mechanical information topics. During and shortly after World War I, tests of mechanical information (44) were partly pictorial—the student matched pictures in order to show which tools and other objects were used together—and partly multiple-choice tests concerning tools, materials, and processes. The latter type covered such areas as mechanics, electricity, carpentry, cabinetmaking, painting, printing,

[1] At least three of the scales in the Talent information test measure aptitudes that are so well established as important predictors of success in specific vocations that they are here regarded as three separate tests, namely: Mechanical Information, Electrical and Electronics Information, and Vocabulary.

surveying, and other similar activities and contained items of a type which might be learned without actual technical training.

Present-day mechanical information tests are similar, except that electricity and electronics (12) are sometimes separated, since many military and industrial studies show that electrical information, when measured separately, adds substantially to the prediction of success in training programs for electrical occupations (52). In World War II all the services made extensive use of mechanical-information tests with considerable success (9), and such tests are now widely used in multiple-aptitude batteries.

GENERAL PURPOSE

Mechanical information is sometimes used as a straight achievement test when the individuals being tested have had extensive specific training in a given mechanical area. However, the subject matter of the Talent test is such that an individual with interest in and a flare for mechanics would know the items in most cases through his everyday experiences. This sort of mechanical information measures ability to succeed in a variety of mechanical occupations as well as mechanical experience.

DESCRIPTION

In the Project Talent Mechanical Information Test, considerable use was made of general information about automobiles and the common tools and machines with which most boys have some familiarity if they are interested in and active in mechanical work. A carefully designed test of this sort includes a wide variety of information; thus it tends to equalize the rural-urban factor, can be interpreted for a mixed group, and samples the full range of mechanical activities of youths of high school age. A sample item:

To change a tire, one needs a—

A. wrench *
B. pump
C. screwdriver
D. pair of pliers
E. cotter key

FACTORS MEASURED

This kind of test measures in part the ability to assimilate mechanical information when exposed to it. To a certain extent, then, it measures reading ability and general learning ability. However, a

*Answers are indicated by asterisks in the sample items.

well-designed mechanical information test of this type minimizes the verbal factor by including items that make little demand on this sort of ability. The test primarily measures what has been called a mechanical-experience factor in numerous analyses of various multiple-test batteries.

INTERPRETATION

Past mechanical experience or formal training in mechanics should, of course, be considered in interpreting scores on mechanical information tests. Whether the individual is a boy or girl, of course, needs to be considered. In general those who score well on this test will tend to have interest in mechanical activities and will tend to do well in training for a wide variety of mechanical occupations, such as machinist, artillery mechanic, sheet-metal worker, foundryman, aircraft mechanic, auto mechanic, Gunner's Mate, and aircraft pilot. This has been widely demonstrated by many studies in the Armed Forces and in industry.

3. Electrical and Electronics Information

HISTORICAL BACKGROUND

While the Army Alpha in World War I included an occasional item on electricity, the use of electrical and electronics information tests has a fairly short history. Tests of this sort have been used as achievement tests for specific training courses in electricity or electronics (37), but it was not until World War II (10) that they were widely used for the purpose of occupational selection and classification. The Army (40), Navy (52), and Air Force (11) found that information items in the general fields of electricity, radio, and electronics were useful in assigning military personnel to specific training programs. However, civilian versions of such tests for use in selection and counseling were not developed until recently (13).

GENERAL PURPOSE

The test has two uses: (*a*) As a straight achievement test, with the information content specific to a given training area; (*b*) as a predictor test for use in selection, classification, and vocational guidance. The Project Talent test samples a broad range of electrical and electronics information that the average high school student will be exposed to if he is interested in this area.

DESCRIPTION

The Project Talent Electrical and Electronics Information Test includes items of the multiple-choice type. Some items require the understanding of electrical symbols, circuits, components, and the like. Other items require knowledge of common vocabulary terms in electricity and electronics. It is difficult to design such a test to give a normal distribution for an average high school population, probably because the great majority of high school youngsters have little interest in and practically no exposure to electrical information. On a well-constructed test of this sort, therefore, a considerable portion of the high school group will make essentially zero scores. The remaining group, however, will be spread out on the score range, and their scores will correlate well with future achievement in an area similar to the content of the test. A sample item is:

One would commonly adjust voltage with—
A. A potentiometer*
B. An oscillator
C. A vibrator
D. A rectifier
E. A condenser

FACTORS MEASURED

To a considerable extent, items of this type measure past experience. If the items are of the sort that a high school youngster is likely to be exposed to if he is interested in the electrical and electronics field, then the test will also in considerable part measure interest in the area and ability to assimilate this type of information. A low score does not necessarily indicate that a youngster lacks ability to assimilate this kind of information if he is exposed to it; however, if he has not been exposed to this area by age 16 or 18 and has no knowledge in it, the prognosis for his success in an electronics or electrical training program will be relatively poor.

INTERPRETATION

A high score on this type of test should be interpreted as meaning that the individual probably has a considerable degree of interest in the electrical and electronics domain and should make good immediate progress in any sort of training course related to it. That this is true has been demonstrated by a large number of studies in the Armed Forces and also in industry for jobs such as electronics technician, radio-, TV-, or radar-repairman, etc. Scores on this particular Project Talent test, like scores on most other aptitude and achievement

tests, should not be interpreted apart from the rest of the student's aptitude and achievement scores. The entire pattern of scores in a comprehensive battery must be considered, for the test to be maximally useful in counseling youngsters concerning entrance into electrical, electronics, or engineering training programs.

4. Vocabulary

HISTORICAL BACKGROUND

Vocabulary is one of the oldest types of tests. Well-structured formal tests of vocabulary were current well before 1910 (33). Vocabulary played a prominent part in the earliest intelligence tests and plays a major part in most intelligence tests today, except for those specifically designed to be nonverbal. Vocabulary has also customarily appeared in all general achievement batteries. There has been much debate over the years as to whether it really measures achievement or aptitude, and the answer probably is that it measures both. Vocabulary was found with the development of factor analysis to define one of the most important primary mental abilities (53). It has played a prominent part in omnibus-type selection tests used by the military, and it appears in virtually all multiple-aptitude test batteries.

GENERAL PURPOSE

The purpose of the vocabulary test is to measure the extent of the student's knowledge of vocabulary at the recognition level. Whether vocabulary achievement is regarded as achievement per se or as basic aptitude depends on the past background of the subject and the purpose for which the test score is to be used.

DESCRIPTION

Vocabulary has been measured in a number of ways, such as: (*a*) By completion items, where the task is to write in the definition of a word; (*b*) by multiple-choice definition items, where the task is to match a word and a definition; (*c*) by opposites items, where the task is to choose the opposite of the stem word; and (*d*) by verbal analogies, where the task is to choose a word that is analogous to another. All these formats tend to give similar results, since they all provide measures of verbal facility. Analogy items build a little reasoning ability into vocabulary tests, but it is evident that what is measured

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is mostly the verbal factor. Many of the items in the Talent vocabulary test are of the definition type; for example:

Questionable—means
A. inquiring
B. doubtful*
C. inquisitive
D. true
E. false

FACTORS MEASURED

The Project Talent Vocabulary Test is intended to measure ability to comprehend words; i.e., recognition vocabulary. It is not intended to measure expressive vocabulary, either written or oral. In line with the purpose of the test, to measure the ability to comprehend the writing of others rather than the ability to express oneself in writing, understanding at a fairly gross level is involved.

Very fine differentiations in meanings and implications, which are more a matter for the master stylist in English than for the "journeyman users" of the language, are not a matter of concern. Thus, although according to the dictionary there is a slight difference in implication between "questionable" and "doubtful" (e.g., when used as the final word in the sentence: "His honesty is ————"), the meanings are so similar that for purposes of this test the two words can be considered synonymous. The fact that the person may know the answer to an item in this test is certainly not to be considered a guarantee that he would *use* the word appropriately. All that can be inferred is that he would have a reasonably accurate understanding of the meaning that the word is intended to convey. The test furthermore is concerned with *written* English, not with spoken English. The fact that a person knows the answer to a certain question means that he understands the word when he encounters it in writing, but this is no guarantee that he will understand it in spoken form; in fact, there is a good chance that he will not, if the word is one which is pronounced quite differently from the way its spelling would suggest—"indict," for instance.

INTERPRETATION

Language is one of the most important basic elements of our modern culture. A person unable to assimilate his mother tongue after having gone to school for several years is likely to be handicapped in dealing with any sort of symbolism or complex situation. A combination of vocabulary score and score on arithmetic reasoning gives a good approximation to most intelligence tests; (22) in fact, vocabulary alone usually has a high correlation with most intelligence tests

of an academic or verbal type. The vocabulary test gives a pure measure of one of the primary mental abilities, verbal facility. Of course, many important human activities do not require much verbal facility. Individuals with low scores in vocabulary but with high scores on other mental abilities can usually be guided into satisfactory occupational channels if properly counseled.

5. Memory for Sentences

HISTORICAL BACKGROUND

Tests of recall memory (17) were developed before the time of Binet and were used by him in his famous scale. A number of intelligence tests include various types of memory items; for example, immediate recall, in which case a set of numbers or a sentence is dictated to the subject and he is asked then to repeat it immediately. Other types of memory tests have been tried, with various intervening periods between the presentation of the material and the testing of the subject. After memory was recognized to be one of the primary mental abilities (53), subsequent research revealed that there are several different kinds of memory (28). A common test today in this area is a test in which the subject is given various sentences for a short period of study; then, after an intervening period, he is tested on what he remembers of them.

GENERAL PURPOSE

The purpose of the Project Talent Memory for Sentences Test is to measure one kind of memory: the ability to recall meaningful material. Recall constitutes a basic ingredient in most kinds of intellectual activity. An individual with poor ability to recall meaningful material would have great difficulty in learning to read or in acquiring an adequate vocabulary. Many people who are functionally illiterate, even after much exposure to schooling, may be so because they lack elemental memory ability. On the other hand, certain individuals may have considerable general intellectual ability, yet have difficulty in recalling meaningful material.

DESCRIPTION

The Project Talent test consists of a number of short sentences, which the students have several minutes to memorize. The items consist of some of the same sentences, with one word omitted from each.

The task, which the examinees are told about at the time they are asked to study the sentences, is to recall the missing word and identify its second letter, which is one of five options.

The following is an example of the sentences to be studied:

Mary tried to catch the four o'clock bus.

This might be one of the items:

Mary————to catch the four o'clock bus.

A
E
I
R*
U

FACTORS MEASURED

The test measures short-term memory, rather than long-term memory, which may be a somewhat different mental factor. It measures memory for materials which the examinee intentionally tries to memorize, not incidental memory, and it does not measure memory for overlearned materials.

INTERPRETATION

The Talent Memory for Sentences Test should be interpreted as being a measure of one mental factor included in the general complex of abstract academic intelligence. Those who do well on the test are likely to do well in immediate rote-learning types of schoolwork and are also likely to make good initial progress in training programs where a great deal of nomenclature and specific facts are to be learned. However, since there are different versions of memory tests and since there are several different types of memory, a counselor should be cautious in generalizing from the results of a test of this type. His interpretations should be guided by the specific validity studies reported in the test manual and in the literature for the specific test that he is interpreting.

6. Memory for Words

HISTORICAL BACKGROUND

Various types of "memory for words" tests (46) have been experimented with, even before World War I, when code-learning tests were being tried out. Memory for words is one type of paired-associates test of learning ability or of memory. The subjects are ex-

posed to pairs of words, one of which is familiar and the other unfamiliar. They are given a short period to study the pairs and then after a variable amount of delay are tested to see how many of them they can recall and still match properly. In the past this has most often been tried as a type of intelligence-test item. One recent version of this type of test is the paired-associates test of Carroll (5) which is a part of his Psi-Lambda foreign language aptitude battery.

GENERAL PURPOSE

The purpose of this test is to measure one kind of rote memory which is probably related to many types of learning or training situations where language or code has to be learned. It is believed to be directly relevant to the ability to learn a foreign language.

DESCRIPTION

In the Project Talent test, which is modeled on Carroll's Paired Associates Test, students are given a short period to study and memorize a list of pairs of words, one in a real language, usually the mother tongue of the student, and the other usually in some synthetic or invented language. The test is then given to measure the ability of the subject to select the English equivalent of the given foreign word from among multiple-choice options. Each foreign word is a separate item and is in a different order from that used in learning the list. The following is a sample:

Vocabulary:

Foreign word	*English word*
KAJELB	walk
DRINVO	potato
MOLO	ear
TAHNE	pretty
etc.	etc.

Sample item:

DRINVO means
A. ear
B. pretty
C. shoe
D. potato*
E. walk

FACTORS MEASURED

There is evidence in a number of studies (5) that this type of test is related to the ability to learn a new foreign language. The Project

Talent test measures ability to memorize pairs of arbitrarily associated expressions when one member of the pair is meaningful and the other is meaningless.

INTERPRETATION

A test of this type has proved to have excellent validity as a predictor of foreign language learning ability. As a result of factor analysis Carroll (5) found that his Paired Associates test measured a factor he designated as "associative memory" and to a lesser extent a factor he called "linguistic interest," both of which were related to course grades in an Air Force "trial course" in Mandarin Chinese. He also found this relationship for learning other modern languages. Studies by other investigators (28) have also shown that rote memory, the skill measured by this type of test, is useful in many kinds of occupational endeavor.

7. Disguised Words

HISTORICAL BACKGROUND

The Project Talent Disguised Words Test is a lineal descendant of a type of completion item that proved useful in a test of aptitude for shorthand (57). Later Carroll (5) modified the item type to adapt it to a multiple-choice format, in which he showed that it plays an important part in the aptitude complex related to the learning of a foreign language. His test, which is part of the previously mentioned Psi-Lambda battery, is called "Spelling Clues."

GENERAL PURPOSE

The function measured by this type of test is probably related to a kind of ability to become used to "strange" modes of spelling. This ability is useful in learning a foreign language; it probably is related to the ability to puzzle out the meaning of a foreign word on the basis of a vague resemblance to a familiar word in the English language. There is a clear analogy between the learning of shorthand and the learning of a foreign language. The underlying psychological variable might be closely similar in some respects.

DESCRIPTION

In the Project Talent test a word is represented by certain letters which suggest the sound of the word. Multiple-choice items are used

to test success in recognizing the word. Each item begins with a word disguised by being spelled somewhat the way it is pronounced. The subject is to indicate that he recognizes the disguised word by marking the choice that most nearly means the same thing. The following are sample items:

1. DSKRIJD
   - A. depressed *
   - B. described
   - C. thrown away
   - D. ruined
   - E. accused

2. DLA
   - A. sadly
   - B. postpone *
   - C. bluntly
   - D. hand out
   - E. every day

The answers to the above items are A and B, respectively, since the words are "discouraged" and "delay."

FACTORS MEASURED

The items are not intended to measure spelling ability—they are in fact designed to minimize it. Neither do they measure vocabulary level directly, except to a very limited degree. Since the exact ways in which the spelling is distorted are not specified explicitly in the directions, the ability measured is, to a considerable extent, that of drawing inferences of a type that would be drawn in learning to read a foreign language.

INTERPRETATION

In interpreting scores it should be remembered that this, like other tests related to language aptitude, measures only one aspect of a complex of abilities. This type of test has been demonstrated to predict success in learning a foreign language. The ability tested apparently applies to most and perhaps even to all languages. Since all the studies, so far, have been with students who have English as a native tongue, the results should be interpreted with caution if applied, for example, to non-English-speaking persons who are learning English.

8. English

HISTORICAL BACKGROUND

Objective achievement tests in the general area of English were well established before World War I (43). These early tests had various types of items on English usage, punctuation, capitalization, and the like, but most of them did not include spelling, which was

covered in separate spelling tests. One of the earliest recorded instances of widespread use of a standardized spelling test was that of Rice (41) who in 1897 administered several versions of his spelling test to about 20,000 subjects. By 1915, spelling scales were highly developed and in widespread use (43).

GENERAL PURPOSE

Many modern English tests are divided into several subdivisions to measure the various components of achievement and to permit diagnostic determination of the areas in which remedial instruction may be needed. The tests are sometimes used in high schools and colleges for placement in English courses. Achievement in English may be sufficiently important to justify using an English test as a basis for selection for many vocational activities also. Whether the test is an achievement or an aptitude test depends on the way it is being used and on the background of the individuals being tested.

DESCRIPTION

The five subtests which constitute the Project Talent English Test yield separate subscores on *spelling*, *effective expression*, *usage*, *punctuation*, and *capitalization*.

Spelling.—Each item consists of four words. The task is to determine which one, if any, is misspelled. Sample items:

1. A. excellent
   B. exercise
   C. exstract *
   D. extreme
   E. none of the above

2. A. affection
   B. complexion
   C. electrician
   D. permission
   E. none of the above *

3. A. atturney *
   B. turned
   C. learned
   D. firmly
   E. none of the above

4. A. altogether
   B. alright *
   C. always
   D. already
   E. none of the above

Effective expression.—Each item consists of two or more sentences, from which the student is to pick the best one. For example:

A. Things such as this helped our forefathers push back the wilderness and create the richest nation in the world.*

B. Our forefathers created the richest nation in the world, helped by things like this to push back the wilderness.

C. Things such as this helped our forefathers in their pushing back of the wilderness and in their creation of the richest nation in the world.

D. To create the richest nation in the world, our forefathers, being helped by things like this, pushed back the wilderness.

Usage.—Each item consists of a sentence with a word or group of words missing, the missing section being represented by a blank. The task is to determine which of several choices best fits in the blank.

Sample items:

1. Bob _____ arrange it.

   A. might could
   B. might be able to*
   C. could maybe
   D. maybe could
   E. would maybe be able to

2. Ed and _____ planning to go.

   A. myself was
   B. me was
   C. I was
   D. myself were
   E. I were*

Punctuation.—The punctuation subtest has two parts—section *a* (punctuation marks) and section *b* (sentence structure).

In section *a*, each item consists of a sentence in which a section is printed without punctuation. This section of the sentence is then presented punctuated in several alternative ways. The task is to determine which is correct. A sample item:

How blue the sky has turned

   A. sky has turned.
   B. sky has turned !*
   C. sky has turned?
   D. sky, has turned.
   E. sky ; has turned.

In section *b*, each item consists of either a fragment of a sentence, a complete sentence, or two or more sentences run together. The task is to determine which it is and to mark the answer sheet "0" if it is part of a sentence, "1" if it is one complete sentence, "2" if it is two or more sentences run together. Sample items:

1. A course of study including English, French, algebra, American history, and chemistry.
2. The football team having tied one game and won all the rest.
3. Try this, it will help you.
4. Do you know how?

(The answers are 0, 0, 2, and 1 respectively.)

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Capitalization.—The items consist of a paragraph printed all in small letters with numbers beneath certain words. The examinee is to indicate whether the word numbered should be capitalized or begin with a small letter.

INSTRUCTION: For each word that should start with a *capital letter*, mark the answer space that has the same number as the number under the word. For each word that should start with a *small letter*, leave the answer space blank.

george hathaway spent last november in paris with his brother
1* 2* 3 4* 5* 6 7

henry and their young cousin, louis beauregard; they stayed in
8* 9 10 11 12* 13* 14

rather a large hotel overlooking the seine river. in december
15 16 17 18 19 20 21* 22* 23* 24*

they all went to england (to london, i believe), where they spent
25 26* 27 28* 29* 30 31 32

christmas with dr. and mrs. hathaway.
33* 34* 35* 36*

FACTORS MEASURED

Spelling.—The Project Talent test is designed to measure ability to spell—*not* size of vocabulary. Students who do not have an especially large vocabulary but who are able to spell most of the words they have encountered should get a good score; therefore, the test is designed to measure ability to spell reasonably common words, words that have probably been encountered at least once by the students. The students need not be able to define the words, since it is possible for good spellers to know how to spell words they do not exactly understand.

Effective expression.—This test is designed to measure recognition of good sentence structure; i.e., sentences which express ideas clearly, concisely, and smoothly, as opposed to sentences which are awkward, ambiguous, or wordy.

Usage.—This type of item is designed to measure the examinee's knowledge of correct English usage and knowledge of the best way to express a given idea. The examinee is not required to differentiate between definitely incorrect usage and usage which is marginally acceptable but undesirable. Instead, his task is to decide which of several options provides the *best* way of expressing a particular idea.

Punctuation.—One section of the test measures the examinee's ability to use standard punctuation marks appropriately. Knowledge of correct capitalization is not explicitly tested. Another section is to determine whether the student has mastered the concept of what constitutes a sentence—including the fact that every sentence or clause has a subject and a predicate.

Capitalization.—The test measures the examinee's degree of mastery of rules concerning capitalization.

INTERPRETATION

While in many circumstances a total score on a test like this is useful, the scores usually should be interpreted separately for each type of item. As an achievement test, the test measures the results of instruction. How well it does this depends, in large part, on how well it samples the subject matter in each subarea. In recent years there has been increasing emphasis on the need for improving basic skills in English. An achievement test in English given in the early high school years can be useful as a diagnostic tool which will help in achieving this goal. This of course is true in most achievement tests.

9. Word Functions in Sentences

HISTORICAL BACKGROUND

This type of test was originated by John B. Carroll, who designed it as a measure of foreign language ability. His analytical studies (5) have shown that it measures an aspect of the ability to learn languages, and experimental studies have demonstrated that it is significantly related to success in modern language training courses.

GENERAL PURPOSE

This test measures ability to understand the function of words and phrases in a sentence. It is intended to measure sensitivity to grammatical structure, regardless of formal training in grammar.

DESCRIPTION

Items in the Project Talent test consists of a "key sentence" and one or more other sentences. The key sentence always contains a key expression, designated by capital letters. The task is to determine which of the underlined words or phrases in the following sentence or group of sentences performs the same function as the key expression. For example:

1. Jean is slicing some BREAD.
   My sister Annette has tied the dog to the trunk of a pine tree.
   A B C* D E

2. They walked GAILY down the street.
   The newly arrived couple used up their money too fast.
   A B C D E*

3. Beauty is truth; TRUTH beauty.
   The meeting place will be the clubroom; the time 8:30 P.M.
   A B C D* E

4. Yesterday Mrs. Smith baked a CHOCOLATE cake.
   Joe had three tennis balls in his locker.
   A B* C D E

FACTORS MEASURED

While this type of test has demonstrated validity for measuring the ability to assimilate new foreign languages, it should be remembered that it is only one of several aspects of this ability. A high score on this test alone, of course, would not indicate definitely that the person would do well at learning a foreign language, but a high score on this together with a high score on tests that measure other aspects of learning a foreign language would indicate a highly favorable prognosis.

INTERPRETATION

Although formal training in grammar and previous study of foreign languages (particularly of highly inflected ones, like Latin) are probably of some help on this test, the fact that the terminology of grammar is not used at all should contribute to reducing the effects of formal training to a minimum. To perform well on the test, a student must understand something about sentence structure and recognize the function of each word or phrase in the sentence. The ability measured by this test is probably related to the ability to learn the grammar and characteristic sentence structure of a foreign language, particularly such a language as Latin, in which word order is typically different from that of English.

Since this type of test is so new, results should be interpreted with caution until experience is gained with it in a greater variety of situations. Nevertheless, existing data suggest that the test measures one of the important abilities involved in the mastery of a new foreign language and that it should thus be useful in the counseling of high school students.

10. Reading Comprehension

HISTORICAL BACKGROUND

Objective reading tests were developed initially as early as 1915 (50). Various types of standardized reading scales were developed

in the early years. At times, reading comprehension tests have been used as part of selection and classification batteries.

GENERAL PURPOSE

This type of test can be designed to measure the level of difficulty of material that a person can comprehend and/or the rate at which he can comprehend material.

DESCRIPTION

The Talent Reading Comprehension Test is in the paragraph comprehension format. Various reading passages are accompanied by items which ask multiple-choice questions regarding the interpretation of the material read. The subject is allowed to refer back to the passage, if necessary, in working the items. A sample passage and items:

A. PASSAGE.

(1) Photography is the most self-conscious of the arts. The act of photography
(2) has been glorified in the newspicture magazines, and even in the newspapers.
(3) Publisher and reader enjoy shoptalk together. The editor continually points to
(4) "best shots," or "news-picture of the week," confident th[illegible]his clientele is
(5) following every move of the shutter. For instance last week's issue of one
(6) popular magazine described how the photographer leaned far out of her plane to
(7) snap "such stunning pictures as the one on page 32." In the writing profession,
(8) there is nothing that quite corresponds to this sort of cameraderie. The
(9) writer might well complain of feeling left out. Perhaps he makes a mistake
(10) not to make more fuss about the mechanics of his writing. When he tosses off
(11) a particularly neat ablative absolute, or kills a hanging participle in the
(12) last three seconds of play, maybe the editor should call the matter to the
(13) attention of the reader. A writer does a lot of work the reader isn't conscious
(14) of, and never gets any credit. This paragraph was exposed for eighteen
(15) minutes, in a semi-darkened room. The writer was leaning far out over his
(16) typewriter, thinking to beat the band.
(17) Of course, it may be that the [illegible]t of photography and the art of writing
(18) are basically different from each other. The hope and aim of a word-handler
(19) is that he may communicate a thought or an impression to his reader without
(20) the reader's realizing that he has been dragged through a series of hazard-
(21) ous and thrilling situations involving decisions on grammar, or that he has
(22) only narrowly escaped some grotesque word arrangements. In photography, the
(23) goal seems to be to prove beyond a doubt that the cameraman, in his great
(24) moment of creation, was either hanging by his heels from the rafters or was
(25) wedged under the floor with his lens at a knothole.

B. ITEMS BASED ON ABOVE PASSAGE.

1. The term "clientele" in line 4 refers to

   A. publisher.
   B. writer.
   C. photographer.
   D. editor.
   E. readers.*

2. The last two sentences of the first paragraph (lines 14–16) are intended to be

   A. informative.
   B. flippant.*
   C. surprising.
   D. depressing.
   E. boastful.

3. The term "word-handler" on line 18 means

   A. reader.
   B. publisher.
   C. writer.*
   D. typist
   E. picture editor.

4. The author of this passage thinks that writing should appear to have been done

   A. under stress.
   B. effortlessly.*
   C. carelessly.
   D. only with great difficulty.
   E. purposelessly.

5. The author of this passage seems to feel that in presenting photographs to the public the stress put on the mechanics of the picture-taking process is

   A. excessive.*
   B. admirable.
   C. necessary.
   D. frightening.
   E. subtle.

6. In the well-known saying that "One picture *is worth* a thousand words," the author of this passage might want to change the words "is worth" to

   A. is usually much better than.
   B. is sometimes talked about in.*
   C. is seldom as good as.
   D. deserves.
   E. is harder to create than.

FACTORS MEASURED

Reading comprehension tests can measure understanding of a wide variety of subject matter. In the Talent test, the passages on which the items are based include some sections on social studies, some dealing with natural science, some of a literary character, etc. The test measures reading with comprehension, rather than merely recognizing the printed word without understanding the fact, concept, or idea

that the writer is attempting to convey. No effort was made to measure comprehension of difficult vocabulary, since that is measured specifically by a vocabulary test. Reading comprehension skills have been grouped by Davis (14) into the following nine categories. Of these categories, all but the first are covered directly by items in the Talent Reading Comprehension Test.

1. Knowledge of word meanings.
2. Ability to select the appropriate meaning for a word or a phrase in the light of its particular context.
3. Ability to follow the organization of a passage and to identify antecedents and references in it.
4. Ability to select the main thought of a passage.
5. Ability to answer questions that are specifically answered in a passage.
6. Ability to answer questions that are answered in the passage but in words other than those in which the question is asked.
7. Ability to draw inferences from a passage about its content.
8. Ability to recognize the literary devices used in a passage to determine its tone and mood.
9. Ability to determine a writer's purpose, intent, and point of view; i.e., to draw inferences about a writer.

INTERPRETATION

Individuals with good reading performance may be expected to perform well in most academic situations of a liberal arts nature. In the case of an individual making poor scores in reading, his other test scores and relevant background should be studied carefully to see whether he seems to have a specific reading disability or whether he just has low academic potential.

Most poor readers in the average school situation probably are poor readers because they do not have the basic potential to learn to become good readers. Of course this conclusion could not be drawn in inadequate school situations. Other causes of poor reading ability such as poor instruction, low ability to remember, and lack of experience also may be factors. There will be a certain number of individuals who score well on other types of intellectual tests but who have a specific deficiency in reading performance. Such persons often respond well to remedial training and eventually become adequate readers. Sometimes specific reading deficiencies are caused by underlying emotional factors. Experienced reading clinic personnel are trained to determine this source of trouble.

11. Creativity

HISTORICAL BACKGROUND

Many attempts have been made to measure creativity or ingenuity. One type of item which has persisted was developed by Terman (48) in 1906 and is still used in the 1960 version of the Stanford-Binet Intelligence Test. Perhaps the most comprehensive effort in recent years has been that of Guilford (29) who studied the interrelations of many tests of fluency, imagination, and originality. A recent development is the new type of item designed by Flanagan (23) to measure ingenuity, inventive skill, and the ability to devise ingenious procedures, equipment, or presentations. Flanagan has developed a new response format which avoids suggesting the correct responses to the problem presented. The examinee is given a problem and a few clues and is required to devise an ingenious solution to the problem.

GENERAL PURPOSE

This type of test is designed to measure the ability to find ingenious solutions to novel problems, to measure something over and above tests of logical reasoning where the problems are highly structured and have formal single solutions. There is some evidence that this ability is related to many kinds of creativity.

DESCRIPTION

Each item in the Project Talent Creativity Test consists of a complex problem similar to one that might be encountered in real life. The examinee must think of a clever or ingenious solution. The correct solution (word or phrase) seems to "click" into place, and the examinee has a definite feeling of closure when it occurs to him. The choices are given in terms of the first and last letters of possible right answers. This is to insure that the examinee really develops the solution, instead of just picking it out from among five alternatives. A sample item:

A man's wife accidentally dropped her ring and it rolled under the seat of the car. The space was too narrow for the man to reach the ring with his hand. He recovered the ring by using a piece of wire to make a

A. b___l
B. s___p
C. s___w
D. h___k (hook)*
E. v___l

FACTORS MEASURED

As would be expected, the Project Talent Creativity Test in part measures general ability of the type measured by intelligence tests. Analysis of the test in relation to other standard types of aptitude tests shows that it has a moderate amount of overlap with various kinds of reasoning tests, especially with mechanical reasoning. However, there is an appreciable amount of unique variance measured independently by it, and not covered by other kinds of verbal or reasoning tests that have been tried out in conjunction with it.

INTERPRETATION

High scores on this type of test should be interpreted as indicating a degree of inventiveness or creative ingenuity on the part of the individual. Such scores would indicate that the individual should do well in dynamic problem-solving activities involving the creation of original solutions to challenging, complex problems.

12. Mechanical Reasoning

HISTORICAL BACKGROUND

As early as World War I, mechanical ability was recognized (62) as a type of measurable ability separate from general intelligence. Early versions of mechanical ability tests were constructed at that time. A little later, various combinations of manipulative, pictorial, and verbal mechanical type items were labeled mechanical ability tests by O'Rourke (36), Stenquist (45), Cox (8), Paterson and others (37), and MacQuarrie (34). It was not until much later that it was recognized that the different kinds of items constituting these mechanical tests were really measuring somewhat different mental factors (30).

In 1940 Bennett (1) developed the first test of mechanical reasoning. By the end of World War II the broad area of mechanical ability (28) had been resolved into such commonly used tests as mechanical and electrical information, tool usage, spatial visualization, eye-hand coordination, and pictorial mechanical reasoning. The latter, in the form employed by Bennett, has been the most widely used. However, many comprehensive aptitude test batteries employ most or all of these types of tests. Despite the high relationship among scores on them, each makes a unique contribution toward predicting occupational success.

GENERAL PURPOSE

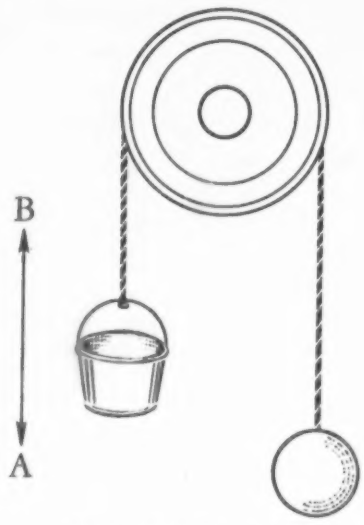
The Project Talent Mechanical Reasoning Test is designed to provide a measure of ability to visualize commonly encountered objects and to recognize how the operation of everyday physical forces and principles affects them. The items cover concepts such as gravitation and common basic mechanisms such as gears, pulleys, wheels, springs, inclined planes, and levers. Such types of tests have sometimes been called measures of "barnyard physics." While such pictorial items cover much of the content of a course in high school physics, a youngster with no formal training in physics can answer them intuitively if he has mechanical ability.

DESCRIPTION

An item of this type in the Project Talent test consists of drawings with questions asked about the action of the parts. For instance, what will one gear do if another moves in a certain way or direction?

Sample item:

Which way will the bucket move when the ball goes up?
A. In direction A (down)*
B. In the direction B (up)
C. There is no way of telling



FACTORS MEASURED

The Project Talent test measures the ability to determine, through visualization and reasoning ability and on the basis of past observations of common mechanical forces at work, how physical objects behave.

INTERPRETATION

There are pronounced sex differences on this, as on all kinds of mechanical tests, and the test may, in part, measure past environmental influences. However, this is no serious practical problem. For some purposes it may be appropriate to use separate norms for boys and girls.

In interpreting scores on this test, due consideration should be given to important past mechanical experiences or formal training in physics. It is important to be aware that so-called "mechanical ability" as measured by this test is only one of the abilities requisite to success in mechanical occupations. Although an engineer may have to have a high degree of verbal, mathematical, and mechanical ability, some mechanics, as craftsmen, may need only a moderate amount of verbal and mathematical ability in addition to mechanical ability.

There is a wealth of evidence supporting the validity of mechanical reasoning tests (47) for a wide variety of occupations ranging from piloting an airplane to truck maintenance. Virtually all comprehensive aptitude batteries have some sort of pictorial mechanical test. They are widely used by the Armed Forces, for example, both for initial selection and for assignment to training. In the extensive validation studies in the Armed Forces, the pictorial mechanical tests almost invariably correlate substantially with measures of success in mechanical training courses. These results are confirmed by many similar studies in industry.

13. Spatial Visualization

HISTORICAL BACKGROUND

Spatial visualization was being measured many years before the ability itself had been recognized as such. It is now realized that some of the tests developed during World War I (62) were measures of spatial visualization. Following World War I, some were included in various mechanical aptitude tests that consisted of several kinds of items (44). After the development of factor analysis in the

1930's a spatial visualization factor became well known as one of the primary mental abilities (53). During World War II, Guilford and others (28) found that there was really more than one kind of visualization or space factor. Many of the military screening tests in World War II and afterwards included measures of spatial visualization. Virtually all multiple-aptitude test batteries today include measures of it. A common test of this type, dating back to World War I, is one in which the subject is shown a drawing of a pile of blocks and must decide how many blocks there are, including those not visible in the drawing.

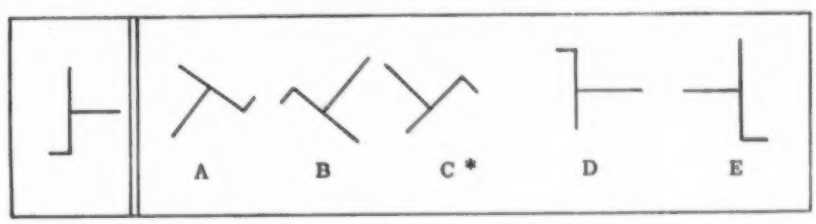
GENERAL PURPOSE

The Project Talent spatial visualization tests (visualization in 2 and 3 dimensions) are intended to measure the ability to visualize the manipulation of a figure in space. It has been found that this ability is involved in many technical, mechanical, or engineering specialities.

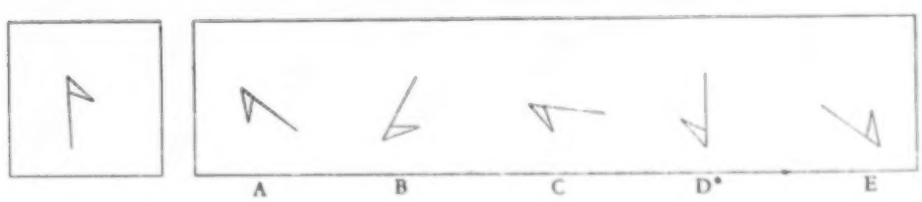
DESCRIPTION

The 2-dimensional spatial visualization items in the Talent battery are of the rotation-reflection type. Each item consists of a lead diagram followed by five other diagrams. The task is to determine which of these options is exactly the same as the lead diagram. In other words, which option, if twisted around without being lifted off the paper, could be made to coincide perfectly with the first diagram? (See sample.) In 3-dimensional spatial visualization a popular type

Visualization in Two Dimensions

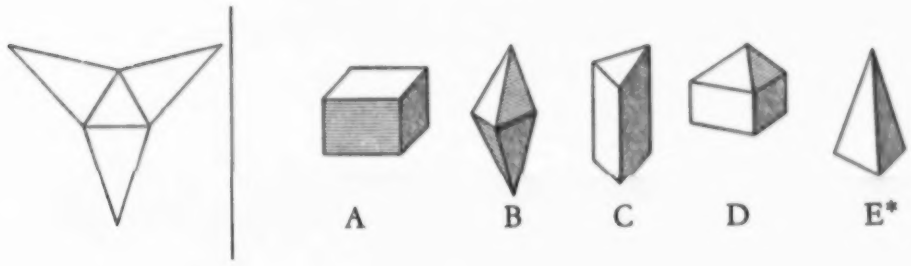


Spatial Rotation and Reflection



of item, the folding item, is used in the Talent test. A diagram of an unfolded object is followed by several diagrams of solid figures. The examinee is asked to choose which of the solid figures the unfolded diagram would make if folded and/or properly cut. (See sample.)

Visualization in Three Dimensions



FACTORS MEASURED

The Project Talent tests measure the ability to visualize manipulation of figures in 2- and 3-dimensional space when the orientation of the figures has been changed. This is an integral part of the ability to do many of the tasks of the design engineer, carpenter, mechanical draftsman, and the like. It also is an ability important in piloting an aircraft or a ship.

INTERPRETATION

These two tests measure two aspects of one of the primary abilities: spatial visualization. This is an important part of the ability to learn to perform mechanical tasks. Such tests are useful for selecting students likely to do well in shop courses; they are also useful in vocational situations where the individual must make a quick adaptation to the demands of certain semiskilled jobs, especially jobs involving assembly, machine operation, or packing objects of different shapes and sizes. This type of test can help select semiskilled employees able to adapt readily to new occupational situations in machine operation or similar work. Because there are a number of variations in these tests, they should be interpreted with caution, following closely the published results in the manual, or the literature, which indicate the specific occupational situations for which the particular test has been found useful.

14. Abstract Nonverbal Reasoning

HISTORICAL BACKGROUND

In an attempt to measure the basic intelligence of individuals who have language handicaps, a number of attempts were made (26) during and even before World War I to develop tests of nonverbal reasoning ability. Several tests of this general type were tried out and used at that time, and today such tests are common. Many intelligence tests, college entrance tests, etc., include measures of abstract nonverbal reasoning, and practically all multiple-aptitude test batteries have a test of this sort.

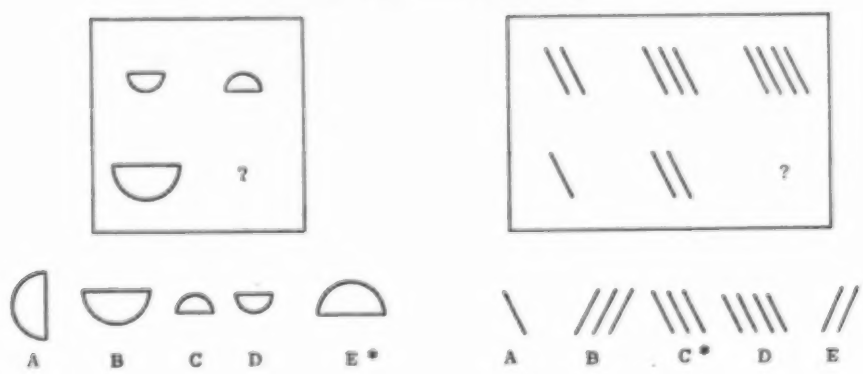
GENERAL PURPOSE

As a nonverbal test of reasoning ability, this test is designed to be more appropriate for use with culturally handicapped individuals than is a test directly involving verbal ability.

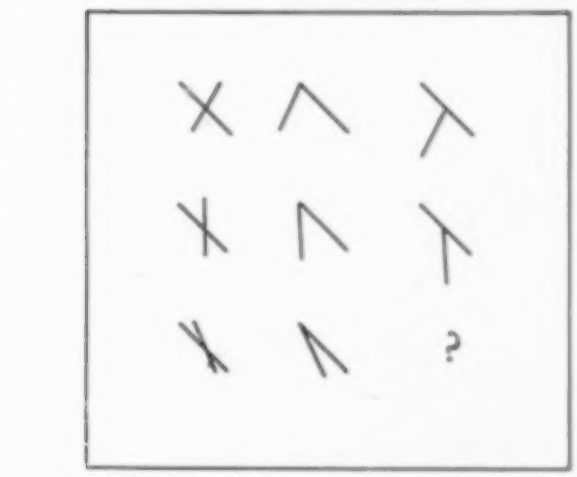
DESCRIPTION

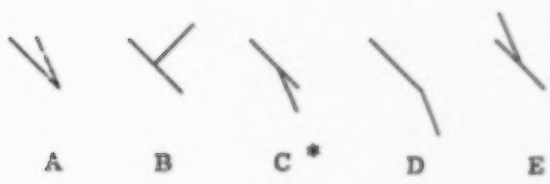
Each item in the Project Talent Abstract Reasoning Test consists of a pattern of diagrams, with one missing portion to be selected from among several options. The solution of the problem depends upon ability to determine the logical relationship of the diagrams in order to identify the missing element. Sample items follow.

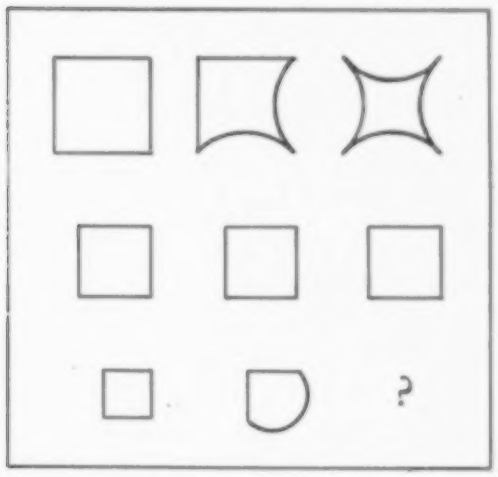
Abstract Nonverbal Reasoning



Abstract Nonverbal Reasoning







FACTORS MEASURED

This type of test measures a kind of reasoning ability; the ability to determine inductively the logical relationships among the elements of patterns.

INTERPRETATION

The scores on the Project Talent Test as well as other tests of this type may be interpreted as a measurement of the ability to do good work in academic curriculums, and they are widely used for this purpose, especially with individuals who have had little schooling or who have cultural or environmental handicaps. Individuals with such handicaps who score low in vocabulary and reading but high on this test can be regarded as having a high innate potential for academic work. However, their low scores on the other tests cannot be disregarded if plans are being made for advanced academic work, since considerable remedial work will presumably be needed before the individual will be ready to perform at an advanced level in school.

For the majority of students in schools, the scores on this type of test should be considered just another element in the general domain of intellectual potential. The student who scores well on this type of test and also on reading, vocabulary, and mathematics tests should be a good student in high school and beyond, if he has the drive and motivation to go with his ability. A low score on this test in conjunction with high scores on verbal tests may indicate a basic interest pattern consistent with better adjustment to occupations in the humanities and the social sciences than in the general area of engineering and science.

15. Arithmetic Reasoning

HISTORICAL BACKGROUND

In the mid-1800's, completion items in arithmetic were being used in connection with New York Regents Examinations (39). They were verbal problems in arithmetic, designed to measure achievement. However, as early as 1910 attempts were being made to use exactly this sort of item as a measure of reasoning ability (4), and the term "arithmetic reasoning" became known at that time. Arithmetic reasoning items have frequently been used in general intelligence tests and were widely used as part of the World War II selection tests. They were also widely used in multiple-aptitude test batteries

at that time, and today arithmetic reasoning is regarded as an important component of aptitude tests.

GENERAL PURPOSE

This type of test is designed to measure the ability to do the kind of reasoning required to solve arithmetic problems. Insofar as possible, arithmetic computation, except at the very simplest level, is excluded by the design of the test. Tests of the arithmetic reasoning type are in most general achievement batteries.

This sort of test is an achievement test, but since virtually everyone today goes to school long enough to be exposed to verbal or reading problems, by the time he has reached the sixth- and seventh-grade level, a measure of whether he has learned to do this sort of thing may legitimately be accepted as a measure of the ability to do reasoning with this type of material.

DESCRIPTION

The Project Talent Mathematics Test has three parts. Part 1 consists of arithmetic reasoning items. They are verbal problems for which the answer can be determined with hardly any computation. Thus the person who has good reasoning ability but tends to make careless errors in arithmetic will not be unduly penalized. Several devices are used to eliminate computation from the items entirely, one being to require the examinee to tell how he would solve the stated problem, but not to do the computation involved in actually solving it. Scratch paper must be provided for this type of test. Typical sample items:

1. 600 is 2 percent of
   - A. 3
   - B. 12
   - C. 1200
   - D. 30000*
   - E. None of the above

2. A pencil costs 4 cents. To find out how much 156 pencils cost, you should
   - A. Add
   - B. Subtract
   - C. Multiply*
   - D. Divide
   - E. Subtract and then divide

3–4. "Apples are selling at 14 cents per lb. Mrs. Smith buys 8 apples. Their total weight is 3½ lbs. She gives the clerk $5.00, and he accidentally gives her 25 cents too much change."

3. What fact that is given above is not needed to figure out how much change she receives?

A. Price per lb.	(14 cents)
B. No. of apples bought*	(8)
C. Total weight	(3½ lbs.)
D. Amount of money given clerk	($5.00)
E. Amount of extra change	(25 cents)

4. Not enough information is given to figure out the

A. Number of quarters Mrs. Smith is given*
B. Amount of change she should have received
C. Average number of apples per lb. in her purchase
D. Average price for a single apple
E. Approximate weight of a dollar's worth of apples

FACTORS MEASURED

Many factor analyses have demonstrated that tests of this type measure not only arithmetic achievement, but also reasoning ability. The latter is an important component of general abstract intelligence. As a matter of fact, a combination of a vocabulary test and an arithmetic reasoning test gives a close approximation to many IQ tests.

INTERPRETATION

The kind of achievement measured by this type of test is inherently important in many aspects of adult life and is correlated with ability in many activities not having the remotest connection with mathematics.

A person scoring well on this type of test should be capable of a high level of achievement in any educational program or training course involving quantitative analysis. Also, such an individual should be able to deal adequately with many complex situations of a problem-solving nature even though the problems may not be mathematical at all.

16. High School Mathematics

HISTORICAL BACKGROUND

For over a hundred years written mathematics examinations have been used on Regents examinations (39). These examinations included a mixture of achievement items in all areas of mathematics taught in high school. In the very early 1900's mathematical problems and arithmetic reasoning (which is, in effect, mathematics achievement at about the sixth- and seventh-grade level) began to be tested separately in connection with intelligence tests (62).

GENERAL PURPOSE

Measures of performance in higher mathematics, such as algebra, geometry, or trigonometry, are in most situations more appropriately regarded as measures of achievement than of aptitude, since the amount of exposure to this type of subject matter is highly variable, whereas virtually everyone is exposed to arithmetic reasoning problems in elementary school. In schools where more advanced mathematics is taken as a required subject, achievement measures of it may be used to indicate basic potential for that sort of mental process. On the other hand, if the subject matter is elective, as algebra and the other advanced areas generally are, then measures of it must be regarded primarily as measures of achievement.

The purpose of a mathematical achievement test is to measure how well an individual can perform in various mathematical areas. Such a test can be used to diagnose weaknesses and assign remedial instruction. It may also be used as a prerequisite for entrance into occupational training courses where mathematics is important, for instance high-level electronics training programs.

DESCRIPTION

The Project Talent Mathematics Test (Parts II and III) consists of standard multiple-choice items designed to measure understanding of concepts and ability to apply them, rather than mere rote memory. Sample items are shown below.

If t+2=8, what does t equal?

A. 4
B. 6*
C. 10
D. 16
E. None of the above.

In 3-dimensional geometry, the locus of a point 5 inches from a given point and 3 inches from a plane through that point is

A. one straight line
B. two straight lines
C. one plane
D. two planes
E. two circles.*

FACTORS MEASURED

Part II of the Talent Mathematics Test measures achievement in mathematics through the ninth-grade level (other than arithmetic

computation and arithmetic reasoning); Part III measures achievement in college preparatory mathematics, generally taught in grade 10 or beyond. The items are such that if considerable time has elapsed since the student studied the material, and if he has consequently forgotten it, he should be able to reconstruct it fairly rapidly, through logical analysis, provided he really understood it thoroughly in the first place.

INTERPRETATION

An achievement test is designed to sample and measure the results of instruction. Users therefore should consider the total pattern of coverage of skills and subject matter in the test.

17. Arithmetic Computation

HISTORICAL BACKGROUND

Arithmetic computation tests are among the oldest types of standardized tests. Well-developed tests of this type were available 50 years ago (62). Such tests customarily measure the ability to do computation problems at about the fifth- or sixth-grade level. Easy items of this sort have sometimes been used in general intelligence tests. General achievement-test batteries also customarily have a section on arithmetic computation. For measuring computational aptitude, most modern tests use fairly simple computation administered under highly speeded conditions. Tests of this sort are found in virtually all multiple-aptitude test batteries today.

GENERAL PURPOSE

The purpose of the Talent test is to measure speed and accuracy of computation (addition, subtraction, multiplication, and division) with whole numbers. A fairly short time limit is used, and the items are fairly easy; thus the individual will usually give a correct answer to a high proportion of the items he reaches. In arithmetic computation tests designed primarily as achievement tests, the variety of operations covered is greater, the problems more difficult, and the time allowance more liberal than in aptitude tests.

DESCRIPTION

The four types of items in the Project Talent test are addition, subtraction, multiplication, and division. Sample items:

1.	63 22 +17 ——	A. 92 B. 102* C. 112 D. 212 E. 912
2.	38 −9 ——	A. 19 B. 27 C. 29* D. 31 E. 39
3.	32 ×15 ——	A. 182 B. 192 C. 325 D. 480* E. None of these

FACTORS MEASURED

This type of test measures the ability to perform simple numerical computations at a high rate of speed with acceptable accuracy, an important aptitude in all types of mathematical, quantitative, or accounting occupations and professions. An arithmetic test with a variety of items measures a function closer to arithmetic reasoning if fractions, ratios, percentage, etc., are included; therefore, they were not included in the Project Talent Arithmetic Computation Test.

INTERPRETATION

Scores on tests of simple operations with whole numbers are not highly related to scores on arithmetic reasoning or other mathematics tests. It is possible to do well in mathematics without being outstanding at simple arithmetical computations. However, a student low on computation will be likely to be handicapped in any occupation requiring accurate and rapid computing, such as bookkeeping or accounting.

18. Table Reading

HISTORICAL BACKGROUND

Table-reading tests are fairly new. They were first widely employed in World War II. At that time a table-reading test which Guilford (28) modeled after an earlier quantitative perception-type

test by Flanagan (21) was developed as a "job sample" test for selecting navigators. However, the test was later found to be useful in predicting success in a wide variety of occupational activities, some of them not directly concerned with table reading at all (11).

GENERAL PURPOSE

The purpose of this test is to measure the ability to obtain information from a table under speeded conditions. This is a more complex kind of clerical aptitude than that measured by clerical checking tests.

DESCRIPTION

The items in the Project Talent Table Reading Test consist of tables with instructions on how to use them, together with a number of multiple-choice items that have to be answered by reading each table and obtaining the answer to the question. These tests are always highly speeded. A sample table and table reading items are given below.

COST IN DOLLARS FOR GROSS QUANTITIES OF VARIOUS TYPES OF HANDKERCHIEFS

Gross Quantity	Cost in Dollars			
	Type VVV	Type V	Type X	Type Y
4	144.00	115.20	92.16	80.64
6	207.36	164.16	138.24	120.96
8	276.48	218.88	172.80	149.76
10	331.20	259.20	216.00	187.20
14	443.52	342.72	282.24	241.92
18	544.32	440.64	362.88	311.04

PROBLEM: To determine the cost of type Y and type X handkerchiefs in the gross quantity given for items S 1 and S 2.

Item No.	Gross Quantity	Type of Handkerchief	A	B	C	D	E
S1	14	Y	311.04	282.24	241.92	443.52	342.72
S2	4	X	80.64	115.20	144.00	187.20	92.16

(The answers are C and E, respectively.)

FACTORS MEASURED

The Project Talent Table Reading Test measures the ability to acquire data from a table. The tables are relatively simple; that is, almost everyone will understand what to do after reading the instructions, and the task is largely to work as many items as possible with minimum errors in a limited amount of time. Some previous tests of this type had many complex items where the primary factor measured was the ability to understand what to do. While such tests have good validity for a number of professional and occupational areas, their factorial complexity would be a disadvantage in a battery such as Project Talent. In connection with a comprehensive set of aptitude measures, it is preferable to keep the test simple as in the Project Talent battery.

This type of test measures a kind of clerical ability that is somewhat more complex than that measured by the type of clerical speed and accuracy tests discussed under the heading "clerical checking." These two Project Talent tests complement each other, and both may be employed in assessing clerical ability. This is especially true in the case of clerical ability for a more complex type of clerical operation than simple clerical checking.

INTERPRETATION

A student's score on the Project Talent Table Reading Test may be regarded as a measure of his ability to do work involving the extracting of data from various kinds of tables, as in the work of navigators, accountants, bookkeepers, statistical clerks, etc. These occupations ordinarily require considerable reading ability, vocabulary, or reasoning ability. For example, in assessing a student's potential for successfully absorbing training for becoming an accountant, the counselor should remember that ability in these other areas is important. He should not conclude that the student has high ability for this type of occupation solely on the basis of a high score on the table reading test; however, no matter how high the score on other types of aptitude tests, a student scoring low on the table reading test would probably be handicapped in any occupation where this sort of activity plays a prominent part.

19. Clerical Checking

HISTORICAL BACKGROUND

The first clerical checking tests were designed during World War I (62). A test of this type was included in the Army Beta Intelligence

Test. Numerous factor analyses have identified a clerical speed factor measured by tests of clerical checking (61). Tests of this sort are commonly found in practically all multiple-aptitude test batteries today.

GENERAL PURPOSE

This particular Project Talent test measures important aptitudes involved in clerical work—speed and accuracy of perception in a clerical task involving verbal materials such as names, numbers, or combinations of names and numbers.

DESCRIPTION

The Project Talent test consists of pairs of names, numbers, or combinations of both. The subject is to compare them and to indicate whether they are the same or different. A sample item of a name comparison format is given below. This type of test is always highly speeded. The time limit is short, so that no one will have time to finish, but ordinarily a large number of items can be worked.

> The task is to compare two names and to mark S on the answer sheet if they are *exactly* the same and D if they are different.
>
> | | |
> |---|---|
> | 1. Joe Abernathy | Joe Abernethy |
> | 2. Charles Q. Piltdown | Charles Q. Piltdown |
> | 3. Mary Ann Wilsson | Marianne Wilsson |
>
> (The answers are D, S, and D, respectively.)

FACTORS MEASURED

This test measures a kind of clerical perception which is relevant not only in clerical jobs but also in jobs which, although they are essentially nonclerical, have a substantial component requiring this type of accuracy. Factor analyses indicate that the test to some extent measures a general speed factor but primarily measures the specific aptitude associated with the ability to do occupational work analogous to the type of test item presented.

INTERPRETATION

The score on this test may be regarded as indicating ability to succeed in the type of clerical tasks involved in the work of accountants, bookkeepers, statistical clerks, and occupations which also have strong requirements for other mental factors such as reading, vocabulary, or reasoning ability, and therefore require a considerable amount of

academic ability *plus* clerical speed and accuracy. Since clerical speed and accuracy have a relatively low correlation with abstract intelligence, some people who are good at academic tests but have low ability in clerical speed and accuracy might have trouble if assigned to jobs such as bookkeeping or accounting.

20. Object Inspection

HISTORICAL BACKGROUND

Form perception tests used during World War I (62) consisted of multiple-choice items involving the matching of geometrical forms and were called form recognition tests. Later, during the 1930's, numerous factor analyses disclosed that the form perception test measures a primary mental ability (53). Virtually all multiple-aptitude test batteries today include a test of this type.

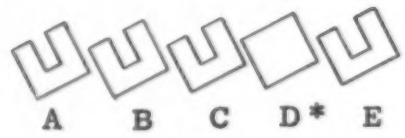
GENERAL PURPOSE

Speed and accuracy of perception of form have been found to be basic perceptual factors which always show up in the analysis of any comprehensive group of aptitude tests. The person scoring high on this type of inspection ability will be able to inspect with a high degree of speed and accuracy objects analogous to or consisting of geometrical forms.

DESCRIPTION

The items in the Talent Object Inspection Test consist of pictures or drawings of five small objects, four of them identical, one slightly different. The task is to pick out the one that is different. Some of the alterations are slight, some rather gross; a student with relatively little skill in this area should get at least a few items right, and a highly skilled student should be able to get nearly all that he reaches correct. However, the text is highly speeded so that no one should have time to finish. A sample item:

> DIRECTIONS: Each problem consists of pictures of five small objects, four of which are supposed to be identical. The remaining one is slightly different. You are to pick out the one that is different, and mark the answer space for it.



Object Inspection

FACTORS MEASURED

The ability measured is an important kind of perceptual skill, used in occupations where one of the job elements is an inspection-type activity. It is valid for many assembly-line type operations and also complex engineering activities where inspection of det[illegible]s an important element. The test also measures one of the important primary mental abilities.

INTERPRETATION

The scores on these types of tests are essentially uncorrelated with academic abilities; therefore some of the poorest students may make some of the highest scores, since they may have a special ability which if properly used, can be a real occupational asset. However, when a subject's scores on general academic ability tests are extremely low, he will have difficulty adjusting to almost any sort of occupation other than routine types of carefully supervised industrial jobs.

IV. Purpose of Standardized Tests

Achievement Tests

ONE OF THE MAJOR VALUES of standardized achievement tests is that they can supplement teacher-constructed tests by providing a basis for comparing the performance of the students in one particular class with that of some larger, representative group. However, their primary purpose is to obtain information about students in an economical and objective manner for use in teaching, counseling, selection, and placement.

Generally teachers construct and give a number of tests at various intervals during the academic year. These teacher-constructed tests may range from anything as simple as spelling words presented orally to a complex essay demonstrating understanding of a specific subject. Good teachers acquire much skill at this sort of testing, and most testing is done with the teacher-constructed test. In many ways such tests are ideal for the teacher's purpose in evaluating the immediate results of his instruction, but they have one weakness in common: the lack of a common frame of reference or standard for measurement; thus a test constructed by one teacher might be a great deal harder than one constructed by another. Since the ability of students may vary tremendously among classrooms, among schools, and even from year to year within the same school, it is difficult to relate the innate difficulty of a test to the performance of any given class, and percentage scores on such tests may be misleading.

Aptitude Tests

By adding aptitude tests to achievement tests, much can be done to aid in the recognition of the ability of each student, thus making it possible to counsel him appropriately and to make wise decisions in regard to his placement, for the major purpose of aptitude tests is to predict future success in learning or in an occupation. Weighted combinations of tests have often proved highly effective in this pre-

diction. The results are useful in personnel selection and placement and in vocational and educational counseling.

Tests can predict successful behavior in a job either because they directly measure a sample of job behavior or a job element, or because they measure some underlying psychological function that is basic to successful performance of the type of behavior to be predicted. An arithmetic reasoning test score, for example, might not only predict success in an occupation in which arithmetic is used but also predict the ability to learn mathematics at some later time, since the ability to learn arithmetic is much the same ability as that required in learning algebra at a higher level. The arithmetic score might also predict the learning of electronics of a completely nonmathematical nature, because a person who can learn arithmetic well tends to have some of the basic ability involved in learning electronics well.

In general, the value of an aptitude test is directly related to the followup studies that have been made of it. In the use of any such test, followup studies published in the manual designed for the particular test or in other publications must be taken into consideration in interpreting results. Persons making use of test results should be familiar with the empirically observed relationships between test performance and later occupational performance.

The Project Talent battery of tests was developed, standardized, and administered to approximately 450,000 high school students throughout the Nation because of a number of problems and needs that are evident in education. Among these needs are: (*a*) Data secured from a broad and representative reference base to be used in educational research pertaining to such problems as patterns of secondary school courses; (*b*) A well-defined national standard as a basis of reference; (*c*) Data for studying the career decision-making process, especially as it is related to assisting students in attaining the maximum level of development of which they are capable; and (*d*) Data for studying the human resources available for the Nation's expanding technology.

Test Combinations

Common types of standardized aptitude and achievement tests have been described. This section describes some of the combinations of such tests which are in use.

1. General Intelligence Tests

The fact that "intelligence" has been such a poorly defined concept is the reason for much of the confusion and bitter controversy histori-

cally associated with the use of intelligence tests. Although the term "intelligence" has been defined in many ways, the definitions usually include such factors as ability to learn, ability to do mental work, and ability to profit from past experience. Since it has been firmly established that there are many different kinds of learning and an individual good at one kind may be poor at another, it is easy to see why there has been so much confusion about learning ability. Furthermore, although the casual observer might think that an area such as mechanical learning contains homogeneous elements, in the past quarter-century it has been found that there are many different kinds of mechanical learning, sometimes with little intercorrelation between them. Nevertheless, to a limited extent all types of learning do appear to have a common denominator: the complex entity commonly known as general intelligence.

Today, for the most part, general intelligence tests consist of items highly related to success in learning academic subjects of the type taught in college-preparatory curriculums and in college liberal arts curriculums.

Group tests of general intelligence ordinarily consist of combinations of items of vocabulary, arithmetic reasoning, and sometimes abstract reasoning as well. General intelligence tests vary somewhat in their emphasis on the verbal factor, some being almost exclusively verbal but many of them about 50:50 in the ratio of vocabulary items to numerical or quantitative items. Many group intelligence tests may be regarded as aptitude tests primarily measuring the ability to succeed in liberal arts schoolwork. They also have validity for many types of occupational and professional training that embody elements involved in high school or college.

2. Nonverbal Intelligence Tests

Nonverbal intelligence tests usually consist of several kinds of items and frequently tap abstract reasoning and spatial visualization among other kinds of abilities. They are designed primarily to measure the learning potential of persons who have a language handicap or who may have intellectual skills not fully represented in typical verbal tests. In effect, then, nonverbal intelligence tests measure different abilities from those in the general intelligence tests. Accordingly, some people who score low on a general intelligence test might score substantially higher on a nonverbal test. If they have attended school for a number of years, they probably are not very good at school work but do have the ability to learn other useful things.

For persons whose mother tongue is English and who have had several years of schooling, verbal intelligence tests have proved far

superior to nonverbal tests in predicting success in subsequent academic training. This generalization applies even for a person whose reading ability is low (18). It has been found true, for instance, in the literacy training programs in the armed services.

3. Omnibus Selection Tests

Special tests often are developed for predicting success in a specific occupation. For example, a special omnibus test for predicting success in training in electronics might include a combination of verbal items on mathematics, mechanics, electricity, and perhaps other areas. These tests generally yield a single overall score. They have been successful for their limited purpose; however, their general utility is severely restricted by the fact that they are specific to the occupational area for which they have been developed.

College entrance and scholarship examinations usually fall in the omnibus selection-test category; they also may yield a number of subscores. A typical college entrance examination may have an academic-aptitude section, consisting of various types of items designed to measure general intelligence, and also one or more achievement sections. College entrance and scholarship tests usually consist of combinations of a fairly small number of common types of items.

4. Multiple-Aptitude Test Batteries

There are a number of good multiple-aptitude test batteries where each test measures some specific type of ability found to be important in a number of occupational or professional specialties.

The tests are designed for use in combinations to predict success in specialties and thus for use in the selection, classification, training, or vocational counseling of individuals. While no two of these batteries include exactly the same combination of types of tests, most of them in one way or another measure vocabulary, arithmetic reasoning, arithmetic computation, mechanical information and/or mechanical reasoning, abstract reasoning, spatial visualization, clerical checking, and form perception (i.e., object inspection).

5. Achievement Test Batteries

Good general achievement test batteries are available at all academic levels from the primary grades through graduate work. Such bat-

teries are composed of items measuring level of achievement in some or all of the following: Arithmetic reasoning, arithmetic computation, mathematics, reading comprehension, English (including spelling), literature, social studies, biological sciences, and physical sciences.

It should be noted that vocabulary tests, like some of the other achievement tests that usually appear in batteries, are also constituents of aptitude batteries. However, there is a real and important distinction between achievement tests and aptitude tests, even though there is some overlap in the type of items. The purpose of the achievement test is specifically to find out what has been learned. What has been learned, under certain conditions, is often the best prediction of what the individual will learn in future training or education. When the same type of test, such as arithmetic reasoning, is used in both an achievement battery and an aptitude battery, the achievement test items are carefully designed to cover comprehensively the objectives of the teaching program.

Among the objectives of the school program are: To enable the student to acquire adequate basic skills in computation and reading; to teach him to acquire a basic background of information in subject-matter areas such as social studies, science, and mathematics; and to help him understand the implications of knowledge. Some achievement tests are designed to help the teacher determine the individual's status in subdivisions of these broad areas. An arithmetic test, for instance, may differentiate between skill in addition and skill in division. If the test is sufficiently long and if a scoring system is available that indicates to the teacher the areas in which the student is weak and requires supplemental instruction, the test is usually referred to as a diagnostic test.

Achievement test batteries, then, may be used appropriately for several different purposes under the broad categories of evaluation, diagnosis, and prediction. Of course, each of these uses involves its own cautions and skills. Within the category of evaluation several uses are possible, such as individual or group comparisons against a standard base of achievement in an overall area or in various specific areas. Further evaluation can be made in terms of amount of gain in achievement. Achievement test batteries are useful as diagnostic tools in determining subject areas or specific aspects of a particular area in which an individual may be weak. Such weakness, if ignored, might drag down his whole level of educational achievement. The primary purpose of prediction is to provide data to enable counselors and guidance personnel to assist the student in planning an educational program leading toward the most satisfactory utilization of his abilities and interests.

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